

App. No. 10/697,180
Office Action Dated September 8, 2005

REMARKS

Favorable reconsideration of this application is requested in view of the above amendments and the following remarks. Claims 1, 2, 4, 7, and 10 are hereby amended. Claims 20 and 21 are new.

Amendments of claims 1 and 4 are supported by Figures 1-5 and the subject matter of original claim 2. Amendment of claim 2 is supported by Figure 1C and page 7, lines 12-14, and page 10, lines 25-27. Claims 7 and 10 are amended editorially. New claims 20 and 21 are supported by Figures 1-5.

Claims 7 and 10 were objected to for informalities. Claims 7 and 10 are amended to address the concerns of the Examiner. Favorable reconsideration of claims 7 and 10 is requested.

Claims 1 and 2 were rejected as being anticipated by Crowley (US 6,605,866). Applicants traverse this rejection. Crowley does not disclose a lead frame, including an inner lead including a protruded portion that protrudes in a thickness direction so as to have a thickness larger than an inner portion of the inner lead, as required by claim 1. Crowley discloses a lead (54, rejection equates to the claimed inner lead) that is subdivided into a lower portion (59), a middle portion (58, rejection equates to the claimed protruded portion), and an upper portion (57). However, the thickness of the upper portion (57) is not larger than the lower portion (59), as required by claim 1. See Figure 2. Therefore, Crowley does not anticipate the lead frame of claim 1.

Further, Crowley does not disclose a lead frame including a step portion that is formed on both the inner and outer sides of the protruded portion, as required by claim 1. The claimed step portion provides a reduced cross-section of the protruded portion that functions as an external terminal. Even if the etching portion (71) disclosed in Figure 4 of Crowley were considered the claimed step portion, it is not provided on both the inner and outer sides of the upper portion (57). The etching portion (71) disclosed by Crowley is provided to increase the locking strength between a lead (75) and sealing material (76) to minimize the possibility of the lead (75) from detaching from the semiconductor package (70). See column 5, lines 59-63. Therefore, Crowley

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does not recognize the value of reducing a cross-section on the tip side of the protruded portion to provide an external terminal. Therefore, Crowley does not disclose the lead frame of claim 1.

Favorable reconsideration of claims 1 and 2 is requested.

Claims 4-8 were rejected as being anticipated by Chun-Jen (US 6,337,510). Applicants traverse this rejection. Chun-Jen fails to disclose a resin-encapsulated semiconductor device including a step portion formed on both the inner and outer side portions of a protruded portion, as required by claim 4. The depression portion (125) disclosed by Chun-Jen cannot be considered to disclose the claimed step portion since it is not formed on inner and outer sides of any protruded portion. Further, the depression portion (125) disclosed by Chun-Jen is provided for filling with molding compound (140), thereby providing an inner lead (120) of the QFN semiconductor package (100) with stronger stability (see column 3, lines 11-14).

In contrast, the step portion required by claim 4 provides that the tip end portion of the protruded portion is surrounded by encapsulating resin so that a part of the protruded portion is exposed therefrom to form a reduced area external terminal. Another advantage of the claimed step portion is that the outer peripheral side of the inner lead on the upper region is covered by encapsulating resin as shown, for example, in Figure 2D. This structure is effective for suppressing leakage current from the outer peripheral side of the inner lead.

Additionally, the claimed step portion ensures that the protruded portion functions reliably as an external terminal. In the encapsulating step, when resin is interposed between a molding die and the lead frame, the encapsulating resin is prevented from flowing between the resin tape and the protruded portions of the lead frame. As a result, encapsulating resin adhering to the surface of the protruded portions is avoided.

Therefore, Chun-Jen cannot be considered to anticipate the resin-encapsulated semiconductor device of claim 4. Favorable reconsideration of claims 4-8 is requested.

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Claims 4, 10, 12, and 13 were rejected as being anticipated by Lee (US 6,303,997). Applicants traverse this rejection. Lee fails to disclose a resin-encapsulated semiconductor device including a step portion formed on both the inner and outer sides of a protruded portion, as required by claim 4. Lee discloses projections (21) that are provided for improving electrical and heat dissipating performance, however step portions providing a part of the protruded portion to be exposed is not suggested, as required by claim 4. See Figure 11. Favorable reconsideration of claims 4, 10, 12, and 13 is requested.

Applicants would like to comment on the prior art references made of record, but not relied upon.

Peak (US 6,700,187) discloses a semiconductor device in which a protruded portion of an inner lead is not exposed from an encapsulating resin and so does not function as an external terminal. Further, the protruded portion is not provided with a step portion on the side thereof. Even further, the invention disclosed by Peak is not intended to stack a plurality of semiconductor devices and is therefore different from the present invention in purpose, configuration, and effect.

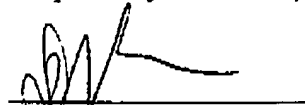
Yang (US 6,790,544) may disclose an inner lead having a protruded portion, however the protruded portion is not provided with a step portion on both sides thereof. Therefore, Yang cannot suggest the effects of the claimed step portions in the present application.

Song (US 5,471,088) discloses a semiconductor device in which electrodes of a semiconductor chip are not face-bonded, but are bonded by wires. Further, the wire-bonded inner lead has a protruded portion that is not provided with step portions on both sides thereof. Thus the invention disclosed by Song cannot be considered to suggest the present invention.

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In view of the above, favorable reconsideration in the form of a notice of allowance is requested. Any questions regarding this communication can be directed to the undersigned attorney, Douglas P. Mueller, Reg. No. 30,300, at (612)455-3804.

Respectfully Submitted,



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